

REPLACED BY
ART 34 AMDT

CLAIMS

1. A humidifying apparatus for fuel cells, comprising a hollow fiber membrane element in which a hollow fiber membrane bundle comprising a large number of hollow fiber membranes is anchored with tubesheets at both ends with the hollow fiber membranes being in the opened state, and a container having at least a supply port of a first gas, a discharge port of the first gas, a supply port of a second gas and a discharge port of the second gas, the hollow fiber membrane element being loaded into the container such that the space communicating with the hollow sides of the hollow fiber membranes is isolated from the space communicating with the outer side of the hollow fiber membranes, wherein

15 (a) the inner diameter of the hollow fiber membrane is larger than 400 μm ,

(b) the water vapor permeation rate ($P'_{\text{H}_2\text{O}}$) of the hollow fiber membranes is $0.5 \times 10^{-3} \text{ cm}^3 \text{ (STP)}/\text{cm}^2 \cdot \text{sec} \cdot \text{cm Hg}$ or more,

20 (c) the ratio ($P'_{\text{H}_2\text{O}}/P'_{\text{O}_2}$) of the water vapor permeation rate to the oxygen gas permeation rate of the hollow fiber membranes is 10 or more, and

25 (d) the elongation at tensile break of the hollow fiber membrane after hot water treatment in hot water at 100°C for 50 hours is 80% or more of that before the hot water treatment.

30 2. The humidifying apparatus for fuel cells as claimed in claim 1 wherein, if the effective length of the hollow fiber membrane element is L and the inner diameter of the container into which said hollow fiber membrane element is loaded is D, L/D is 1.8 or more.

35 3. The humidifying apparatus for fuel cells as claimed in claim 1 or 2, wherein the inner diameter of the hollow fiber membranes is from more than 500 μm to less than 1,500 μm .

4. The humidifying apparatus for fuel cells as

claimed in any one of claims 1 to 3, wherein the membrane filling percentage of the hollow fiber membrane bundle constituting the hollow fiber membrane element is from 35 to 55%.

5 5. The humidifying apparatus for fuel cells as claimed in any one of claims 1 to 4, wherein 50% or more of the outer periphery of the hollow fiber membrane bundle constituting the hollow fiber membrane element is covered with a film-like substance.

10 6. The humidifying apparatus for fuel cells as claimed in any one of claims 1 to 5, wherein the first gas flowing on the hollow side of the hollow fiber membranes and the second gas flowing in the space on the outer side of the hollow fiber membrane flow 15 countercurrently with intervention of the hollow fiber membranes.

20 7. The humidifying apparatus for fuel cells as claimed in any one of claims 1 to 6, wherein a core tube disposed along the hollow fiber membrane bundle is provided nearly in the center part of the hollow fiber membrane bundle constituting the hollow fiber membrane element and communication holes communicating between inside and outside of the core tube is formed in said core tube to allow for introducing the second gas from 25 the second gas supply port into said core tube and then into the space on the outer side of the hollow fiber membranes through said communication holes.

30 8. The humidifying apparatus for fuel cells as claimed in any one of claims 1 to 7, wherein a supply gas to a fuel cell is humidified.

35 9. The humidifying apparatus for fuel cells as claimed in any one of claims 1 to 8, wherein the first gas is an exhaust gas from the cathode of a fuel cell and the second gas is an air supplied to the cathode of the fuel cell.

Amendment

(Amendment under PCT Article 34)

TO: Susumu Ogawa, Commissioner of the Patent Office

1. Indication of International Application

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4. Contents of Amendment

As per attached sheet.

That is,

(1) claims 1 and 2 are amended as per attached
sheet,

(2) claims 3 to 8 are deleted,

(3) in claim 9, "The humidifying apparatus for fuel
cells as claimed in any one of claims 1 to 8" is amended
to "A method for humidifying a supply gas of a fuel cell
as claimed in claim 1 or 2", and

(4) claim 10 is added.

5. List of Attached Documents

Replacement pages of Scope of each one sheet

Claim for Patent (pages 39, 39/1,
40 and 40/1)